

1913, *Fernald, Hunnewell & Long*, no. 8672; exsiccated pond-holes, Lakeville, August 26, 1913, *Fernald & Long*, no. 8668; Brewster, September 11, 1912, *F. S. Collins*, no. 1555; sandy river-shore, Stockbridge, August 24, 1902, *Hoffmann*. RHODE ISLAND: peaty margin of small pond north of Crescent Beach, Block Island, August 20, 1913, *Fernald & Long*, no. 2667. CONNECTICUT: Hart's Upper Reservoir, Berlin, September 27, 1900, *J. N. Bishop*; field, Bridgeport, August 19, 1893, *E. H. Eames*. NEW YORK: Castle swamp, Oneida, August 12, 1906, *House*, no. 2776. NEW JERSEY: Atlantic City, August, 1895, *Scribner*. WEST VIRGINIA: Sweet Springs, September 5, 1903, *Steele*, no. 201; Dry Fork River, near Harmon, September 12, 1904, *Greenman*, no. 52. NORTH CAROLINA: cultivated ground, Biltmore, July 23, 1897, *Biltmore Herb.* no. 809a. GEORGIA: wet meadows, Lafayette, August 2, 1900, *Harper*, no. 343. MISSISSIPPI: near Starkville, September 27, 1896, *Kearney*, no. 7. ONTARIO: Galt, September 1, 1908, *Heriot*. MICHIGAN: Alma, August 28, 1895, *C. A. Davis*; Owasso, August 24, 1890, *G. H. Hicks* (material compared by M. Gagnepain and pronounced identical with the Michaux plant). WISCONSIN: wet grounds, "Native!" Milwaukee, *Lapham*. ILLINOIS: gravelly beach, Sangamon R., White Heath, October 5, 1912, *A. S. Pease*, no. 14,090; swamp along lake shore, Waukegan, August 17, 1906, *Gleason & Shobe*, no. 320. MINNESOTA: Ft. Snelling, August 22, 1891, *E. A. Mearns*, no. 39. MISSOURI: fields, Whiteside, September 11, 1911, *J. Davis*, no. 1017. KANSAS: open ground, Riley Co., 1896, *J. B. Norton*, no. 884b. SOUTH DAKOTA: Huron, *D. Griffiths*, no. 773.

GRAY HERBARIUM.

## NOTES ON NEW ENGLAND HEPATICAE,— XII.

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IN the present series of Notes the following additions to the hepatic flora of New England are reported and discussed: *Fossombronia cristula*, *Lophocolea alata*, *Cephalozia macrostachya*, and *Cephaloziella spinicaulis*. Two other species, *Cephalozia catenulata* and *Calypogeia paludosa*, are included for nomenclatorial reasons, and the paper is concluded by a list of additions to local state floras and a census of New England Hepaticae according to our present information.

1. FOSSOMBRONIA CRISTULA Aust. Proc. Acad. Philadelphia for

1869: 228. On moist sandy or clayey soil. Massachusetts: Amesbury (*J. W. Huntington*, October, 1901); Middleton, Essex County (*H. H. Bartlett*, November, 1908); Reading (*C. C. Kingman*, November, 1908). Connecticut: Milford (*A. W. E.*, October, 1909). New to New England. The following stations outside of New England may likewise be recorded: Axton, New York (*E. B. Chamberlain*, September, 1910); near Batsto, New Jersey, the type locality (*C. F. Austin*, October, 1868, distributed in *Hep. Bor.-Amer.* 121); Highlands, New Jersey (*C. C. Haynes*, October, 1905, and November, 1912, the latter specimens distributed in *Amer. Hepat.* 118, as *F. foveolata*); Morgantown, West Virginia (*J. L. Sheldon*, October, 1909); between Dune Park and Mineral Springs, Indiana (*G. S. Bryan*, 1914).

The elaters of this curious species, as originally emphasized by Austin, yield its most distinctive characters. They are exceedingly inconspicuous; when the contents of a capsule are examined under a low magnification it often appears as if no elaters were present, and a magnification of at least three hundred diameters is essential for their proper study. They are remarkable not only on account of their small size and delicate structure but also on account of their variability in form and scanty development. Their most unusual features, however, are found in the local thickenings of their walls. Instead of forming two or more parallel spirals, these usually consist of from five to nine rings, some of which may be connected to form a single rudimentary spiral. In rarer cases a longitudinal band of thickening is present to which one or more rings are attached. According to a series of measurements made on a part of the type material the elaters vary from  $28 \mu$  to  $58 \mu$  in length and from  $6 \mu$  to  $18 \mu$  in width. But the length and width do not vary proportionally, one elater having a width of  $18 \mu$  being only  $36 \mu$  in length. The bands of thickening are less deeply pigmented than in most species of *Fossombronia* and are sometimes very pale indeed and difficult to demonstrate. According to Stephani<sup>1</sup> the elaters are acuminate, but all those studied by the writer were blunt. The variability in form is indicated to a certain extent by the measurements given: it should be added that most of the elaters are straight or nearly so and that some of them show irregular branching.

The brown spores in the type material are mostly between  $36 \mu$

<sup>1</sup> *Mém. de l'Herb. Boissier* 16 : 31. 1900.

and  $40\ \mu$  in diameter, while those in the material from Middleton, Massachusetts, are mostly between  $40\ \mu$  and  $46\ \mu$ . The spherical face is covered over with a more or less regular reticulum formed by intersecting lamellae about  $2\ \mu$  in height. These lamellae appear pale brownish when seen from the surface, dark brown when seen in profile. No border is developed at the periphery of the spherical face, but the neighboring ridges of the reticulum sometimes give the effect of a narrow interrupted border. The meshes of the reticulum are mostly  $8\text{--}10\ \mu$  wide and the spherical face usually measures six or seven meshes across. Sometimes the reticulum is irregular or incomplete. The three plane faces are not clearly defined, the bounding edges being rounded and destitute of distinct longitudinal thickenings. This portion of the spore-surface is roughened by low and irregular warts and low ridges which never unite to form a reticulum.

A new South American *Fossombronia* with elaters similar to those of *F. cristula* was described by Goebel<sup>1</sup> three years ago under the name *F. Luetzelburgiana*. It was based on material collected in 1911 by Ph. von Luetzelburg in the Serra dos Orgaos, near Rio de Janeiro, Brazil. According to its author the elaters measure  $40\text{--}65\ \mu$  in length and are characterized by annular thickenings with very rare indications of spiral thickenings. The spores measure  $50\ \mu$  in length and are covered over with a lamellate reticulum. It will be seen at once that this species is very close indeed to *F. cristula*. In fact the only essential difference brought out is the dioicous inflorescence, that of *F. cristula* being monoicous (paroicous). Goebel regards the elaters of *F. Luetzelburgiana* as reduced structures and compares them with the sterile cells in the capsules of *Sphaerocarpos*, *Riella*, and *Corsinia*, in which no thickenings whatever are produced.

Among northern species the closest ally of *F. cristula* is *F. foveolata* Lindb. The spores, in fact, are exactly alike in the two species, so far as their surface-sculpture is concerned. According to authors there is a slight difference in the size of the spores. Underwood<sup>2</sup> states that those of *F. cristula* are  $35\text{--}44\ \mu$  in diameter while those of *F. foveolata* are  $42\text{--}50\ \mu$ . Stephani gives measurements of  $37\ \mu$  and  $40\ \mu$ , respectively. These differences are not constant and, even if they were, they would be too slight to deserve much emphasis. With the difference in the spore measurements eliminated there is nothing

<sup>1</sup> Flora **105** : 55. f. 1A, 1B, 2-4. 1912.

<sup>2</sup> Bot. Gaz. **21** : 70. 1896.

to separate *F. cristula* from *F. foveolata* except the peculiar elaters. In *F. foveolata* these are of the type normal to the genus. They are more or less curved and contorted and usually measure 60–100  $\mu$  in length and about 10  $\mu$  in greatest diameter. The spirals are distinct and deeply pigmented with yellowish brown. There are usually two spirals running from end to end, but one or both of these may branch, so that the elater may show three or four spirals through a part of its length. The thin part of the wall sometimes disappears at maturity. The elaters taper somewhat, the ends themselves being either sharp-pointed or blunt.

Although the difference in the elaters is so striking, the lack of other differential characters separating *F. cristula* from *F. foveolata* is somewhat disconcerting. Might it not be possible that the reduced elaters of *F. cristula* were the result of unfavorable conditions during the development of the sporophyte? At the present time there is no evidence to support such an idea. The capsules of *F. cristula* present no appearance of incomplete or abnormal development, and reduced elaters of the *F. cristula* type have not been reported from Europe, where *F. foveolata* is as common as in North America. The only observations which have any bearing on the question are those of Macvicar<sup>1</sup> in his discussion of *F. echinata* Macv. and *F. caespitiformis* De Not., two species of Europe and northern Africa. He finds that the elaters here sometimes become shorter and thicker than is usual, and he associates this condition with incomplete development. These thick elaters, however, still show distinct spirals so that they do not simulate very closely the annular elaters of *F. cristula*. Until evidence is brought forward showing that *F. cristula* is an undeveloped abnormal form of *F. foveolata*, it seems justifiable to regard it as a valid species or, at any rate, as a "kleine Art."

Austin proposed *F. cristula* nearly fifty years ago, and its distinctness has been recognized by Lindberg,<sup>2</sup> Underwood, and Stephani. In spite of these facts no stations have been cited for the species except the original locality. A short time ago Dr. G. H. Conklin sent a slide of the Indiana material for examination with the suggestion that it might represent *F. cristula*. A comparison with the material in Austin's Hep. Bor.-Amer. showed that this suggestion was correct and led to a re-examination of the material preserved as *F. foveolata* in

<sup>1</sup> Rev. Bryol. **38** : 74. 1911.

<sup>2</sup> Acta Soc. Sci. Fenn. **10** : 533. 1875.

the writer's herbarium and in the collection of Miss Haynes. In this way the additional stations cited above were brought to light. They show that *F. cristula* has an extensive range in the eastern United States and indicate that it is a species of southern rather than of northern distribution.

2. *LOPHOCOLEA ALATA* Mitt.; Larter, Devon. Assoc. Adv. Sci. Litt. & Art 1906: 285; Macvicar, Jour. Bot. 45: 260. 1907; Student's Handb. British Hepat. 235. f. 1-6. 1912. *L. cuspidata*, var. *alata* K. Müll.; Rabenhorst's Kryptogamen-Flora 6: 803. 1911. On sandstone along the edge of a brook, Simsbury, Connecticut (*Miss Lorenz*, December, 1914). Although this is the first station to be recorded for North America, the species was discovered at Milford, Pennsylvania, in 1908, by G. E. Nichols and reported by the writer as *L. cuspidata* (Nees) Limpr.<sup>1</sup> It is known in Europe from Great Britain and France. The validity of *L. alata* as a species is not above question and there is even some probability that there are intergrading forms connecting it with *L. cuspidata*. At the same time it presents characters which usually make its recognition easy, and its known range in Europe is decidedly more restricted than that of *L. cuspidata*, from which it is presumably derived. In North America *L. cuspidata* is known only from the Pacific Coast eastward to the Rocky Mountains, so that this evidence also, incomplete as it is, would strengthen the claims of *L. alata* for acceptance.

The differences between *L. cuspidata* and *L. alata* are clearly described by both Macvicar and Schiffner.<sup>2</sup> In *L. cuspidata* the color is pale or yellowish green, the leaves are imbricated and bifid about one fourth, the lobes are subulate and acuminate, the median leaf-cells average about 30  $\mu$  in length, the perichaetial bracts are bifid about one third, with a narrow acute sinus and subulate, acuminate lobes, the bracteole is bifid in a similar way to about the middle or even beyond, and the perianth is sometimes destitute of wings, although narrow wings are occasionally present. In *L. alata* the color is a darker green, the leaves are less closely imbricated and less deeply bifid (usually about one fifth) with shorter lobes, the median leaf-cells average about 40  $\mu$  in length, the perichaetial bracts are less deeply bifid (about one fifth to one fourth) with a lunulate sinus and broader,

<sup>1</sup> Bryologist 13 : 34. 1910.

<sup>2</sup> Lotos 58 : [19]. 1910.

less acuminate lobes, the bracteole is bifid in much the same way as the leaves, and the perianth bears one or more usually broad wings along its angles. Additional differential characters taken from the sporophyte may be quoted from Schiffner. According to his account the spores in *L. cuspidata* average about 16  $\mu$  in diameter, and the elaters have two spirals throughout their entire length; in *L. alata*, on the other hand, the spores usually measure 19–21  $\mu$  in diameter, and the elaters at one or both ends have very often a single spiral for a considerable distance. Unfortunately the Simsbury specimens lack capsules, so that these observations could not be confirmed. In their gametophytic characters, however, they agree closely with the following English specimens: near Castleton, Derbyshire (*H. W. Pearson*, distributed in *Hep. Europ. Exsic. 275*); Cuckfield, Sussex (*W. E. Nicholson*, communicated by Miss Lorenz).

Both *L. alata* and *L. cuspidata* are autoicous in their inflorescence and on this account frequently bear perianths. In *L. bidentata* (L.) Dumort., which agrees with them in many points, the inflorescence is dioicous and perianths are rarely developed. In the form of the leaves *L. bidentata* usually resembles *L. alata* more closely than it does *L. cuspidata*, but the leaf-cells are smaller than in either of the autoicous species and measure 25–30  $\mu$  in the middle of the leaf. The distribution of *L. bidentata* in New England is very incompletely known. Although it has been reported from every state except New Hampshire, the writer has seen specimens from Massachusetts and Connecticut only. It seems to be most at home on moist or wet sandstone.

3. CEPHALOZIA CATENULATA (Hübner.) Spruce, On Cephalozia 33. 1882. *Jungermannia catenulata* Hübner. Hep. Germ. 169. 1834. *J. reclusa* Tayl. Jour. Bot. 5:278. 1846 (in part). *Cephalozia reclusa* Dumort. Hep. Eur. 92. 1874. *C. serriflora* Lindb. Medd. Soc. F. et Fl. Fenn. 3:188. 1878. *C. virginiana* Spruce, On Cephalozia 37. 1882.

Hübener's *Jungermannia catenulata* has been the source of considerable confusion to students of the Hepaticae. It was based on specimens collected in western Germany, the habitat being described as "Torfboden in Sümpfen." According to the original description the lobes of the perichaetial bracts were entire. Spruce considered the species synonymous with Taylor's *J. reclusa* (in a restricted sense) and with Lindberg's *Cephalozia serriflora*, a species with dentate or

spinose bracts, usually growing on rotten logs. According to Spruce the bracts were variable in his *C. catenulata*, the lobes being sometimes entire and sometimes variously toothed. Certain later European writers considered Spruce's species an aggregate. In their opinion the plant with entire lobes represented the true *J. catenulata*, while the one with toothed lobes represented *J. reclusa* or *C. serriflora*. In accordance with these ideas the writer recommended eleven years ago that Lindberg's name be retained for the plant with toothed bracts. It was recommended further that Taylor's name be given up altogether. This suggestion was made because Taylor's species, although older, was based on several distinct plants. Just what the plant with entire lobes represented was not considered because no species answering to the descriptions was known from North America.

A year ago Schiffner<sup>2</sup> was able to clear up the confusion about *J. catenulata* by the study of specimens in the Nees von Esenbeck herbarium at Strassburg. He found that the bracts in this material, which was received from Hübener himself, were distinctly toothed and that the original description was therefore in error when it stated that they were entire. For this reason it becomes necessary to revive the name *C. catenulata* and to apply it to the species which has recently been known in North America as *C. serriflora*. Schiffner showed further that the plant with entire lobes deserved no special recognition, being apparently a mixture of *C. catenulata* and *C. macrostachya* Kaalaas.

It will be noted that *C. virginiana* is included among the synonyms of *C. catenulata*, in spite of the fact that it is accepted as valid by Stephani.<sup>3</sup> Spruce based this species on material collected at Portsmouth, Virginia, and preserved in the Schimper herbarium. He proposed it as new with reservations, emphasizing its close relationship to *C. catenulata*. According to his account the inflorescence in *C. virginiana* is either autoicous or dioicous, the latter condition being the more usual, the androecia are elongated, the perianth is wider above the middle, and its mouth is setulose or ciliolate. In *C. catenulata*, on the other hand, the inflorescence is invariably dioicous, the androecia are short, the perianth is not wider above the middle, and the mouth is setose or ciliate, in other words it has longer teeth. It

<sup>1</sup> RHODORA 6 : 173. 1904.

<sup>2</sup> Hedwigia 54 : 313. text fig. 1-5. 1914.

<sup>3</sup> Bull. de l'Herb. Boissier II. 8 : 375. 1908.

will be seen at once that the differences indicated are based on very variable characters. Through the kindness of Dr. Howe a portion of the type specimen in the Underwood herbarium has been available for study. Since this specimen shows no peculiarities sufficient to warrant a specific separation from *C. catenulata*, and since several European writers have demonstrated an occasional autoicous inflorescence in the latter plant, it seems justifiable to consider the two species synonymous. *C. catenulata* has been recorded from all six of the New England states.

4. CEPHALOZIA MACROSTACHYA Kaalaas, Rev. Bryol. **29**: 8. 1902. *C. multiflora*, var.  $\beta$  *elata* Spruce, On Cephalozia 38. 1902. In bogs. Rhode Island: Westerly (*A. W. E.*, April, 1911). Connecticut: North Branford (*W. R. Dudley*, August, 1882); Woodbury (*A. W. E.*, June, 1902); Bingham Pond, Salisbury (*A. W. E.*, June 1905); Berlin (*G. E. Nichols*, November, 1910); Andover (*A. W. E.*, July, 1911); New Haven (*A. W. E.*, April, 1915). Kaalaas based the present species on material collected by E. Ryan at Glemminge, Norway. Nine years after its original publication it was reported by Nicholson<sup>1</sup> from various localities in Sussex, England, and the following year it was recognized as valid by both Macvicar<sup>2</sup> and K. Muller.<sup>3</sup> The latter writer cited stations for the species from Denmark, as well as from Norway and England, and predicted its discovery in other regions. Later in the same year Schiffner<sup>4</sup> reported it from various localities in Bavaria, from the vicinity of Hamburg, and from Sweden, and last year<sup>5</sup> published the first record for North America, based on specimens collected at Freeport, Long Island, in October, 1898, by M. A. Howe. The stations given above extend its known range into southern New England, and it will probably prove to be as widely distributed on this side of the Atlantic as in Europe. The New England material has been compared with the various specimens distributed in Schiffner's *Hepaticae Europaeae Exsiccatae* and also with a portion of the Long Island material, kindly communicated by Dr. Howe.

In its dioicous inflorescence *C. macrostachya* agrees with *C. media*

<sup>1</sup> Hastings and East Sussex Nat. **1**: 274 pl. 22, f. 10. 1911.

<sup>2</sup> Student's Handb. British Hepatics 263. 1912.

<sup>3</sup> Rabenhorst's Kryptogamen-Flora **6**<sup>2</sup>: 56. f. 17. 1912.

<sup>4</sup> Oesterr. Bot. Zeitschr. **62** 159. 1912.

<sup>5</sup> Hedwigia **54**: 321. 1914.



Lindb. and *C. catenulata* (Hüben.) Spruce, and in certain respects it is intermediate between these two species. According to Kaalaas the elongated antheridial spikes or androecia yield its most distinctive characters. In his description of these spikes he states that the bracts are numerous (sometimes as many as fourteen pairs); that they are two or three times as large as the leaves; that they are imbricated, transversely attached, and bifid (or rarely trifid) to the middle or beyond with acute sinuses; and that the lobes of the bracts are narrowly lanceolate and acute with more or less spinose-dentate margins. He adds that the lower bracteoles are smaller than the bracts but that the upper ones are fully as large and bifid in much the same way. Macvicar and Müller accept the characterization of Kaalaas and lay an equal emphasis on the androecia in distinguishing *C. macrostachya* from its allies.

Schiffner, however, brings out the interesting fact that androecia of the type described by Kaalaas are not of constant occurrence. He finds that the antheridial spikes are sometimes short, that the lobes of the bracts are sometimes entire or nearly so (except for a small tooth on the dorsal margin), and that the bracteoles are sometimes small throughout the length of the inflorescence. He finds further that spikes of this simpler type sometimes occur in connection with spikes of the more complex type and sometimes replace the latter altogether. As he points out the androecia of *C. media* agree in all essential respects with the simpler androecia just described, and it should be added that the androecia of *C. catenulata* agree almost as closely.

On account of the inconstancy of the characters drawn from the antheridial inflorescences Schiffner, in distinguishing *C. macrostachya* from *C. media*, lays emphasis on the shape of the leaves, the peculiarities of the perichaetial bracts, and the teeth at the mouth of the perianth. The features which he considers most important were, for the most part, brought out in the original description, although Kaalaas regarded them as less important than those drawn from the androecia. They may be briefly described as follows: the leaves are bifid to about the middle with an obtuse-lunulate sinus and straight or connivent, acute divisions, each usually tipped with a row of two cells; the perichaetial bracts are bifid to beyond the middle with long acuminate lobes, each usually bearing on the outer edge two slender and often hair-like teeth; the mouth of the perianth has small teeth,

some of which are usually elongated into slender cilia. The contrasting characters in *C. media* are the following: the leaves are usually less deeply bifid, and the lobes, which are nearly always connivent, are more shortly pointed, being usually tipped with a single cell instead of a row of two cells; the perichaetial bracts are less deeply bifid, the lobes are less acuminate, and each usually bears on the outer edge a single broader and often blunt tooth; the mouth of the perianth is minutely crenulate or setulose from cells projecting singly.

To these differences may be added a slight difference in the size of the leaf-cells. Schiffner criticises the measurements in Müller's description of *C. macrostachya*, where the cells are said to be 30–35  $\mu$  in diameter. He notes that the original description gives a length of 23–35  $\mu$  and a width of 19–23  $\mu$ , and he adds that he himself has found the cells to be about 20  $\mu$  in diameter. He suggests that Müller may have made his measurements toward the dorsal base of the leaf, where the cells are invariably larger. From a series of measurements made by the writer on various specimens the cells in the upper part of the leaves were found to average about  $21 \times 18 \mu$ , while those in the basal region averaged about 30  $\mu$  in diameter. In *C. media* the corresponding averages were  $30 \times 24 \mu$  and 35  $\mu$ .

In separating *C. macrostachya* from *C. catenulata*, the leaves and the perichaetial bracts are again of much importance. In this latter species the leaves are bifid to the middle or less with a narrow sinus and usually parallel acute lobes; the leaf-cells, which are about as large as in *C. macrostachya*, have somewhat thicker walls, and the perichaetial bracts are less deeply bifid with broader and less acuminate lobes, the margins of which are coarsely and irregularly dentate or spinose-dentate. *C. catenulata* rarely occurs in bogs, its usual habitat being rotten logs, while *C. macrostachya*, according to the information at hand, is confined to bogs.

It will be seen from the foregoing notes that the recognition of sterile material of *C. macrostachya* or of male material with androecia of the simpler type is beset with difficulties, and it is probably unwise to attempt a positive determination in all cases. For this reason the writer has left unnamed several specimens which he suspects belong to *C. macrostachya*. None of the American specimens so far examined has shown androecia of the complex type described by Kaalaas. All the androecia studied, however, except a few very short ones, have shown small but distinct bracteoles, structures which are usually absent altogether from the androecia of *C. media*.

The gemmiparous form of *C. macrostachya* is distinguished as var. *propagulifera* by Schiffner. He based this variety on a set of specimens collected by H. Paul at Bernau in Bavaria and distributed in Hep. Europ. Exsic. 547. Schiffner states that the gemmiparous stems are terminated by a rather broad bud, which encloses a dense cluster of *Opuntia*-like chains of gemmae. He adds that the gemmae themselves are unicellular and clavate, measuring about  $18 \times 8 \mu$ , that the leaves of the cluster are pointed and toothed in much the same way as the perichaetial bracts, and that underleaves similar to the bracts are likewise present. In No. 547 of the Yale herbarium most of the gemmiparous branches are very small (about 0.25 mm. in diameter), the leaves and underleaves are less sharply pointed and less toothed than Schiffner implies, and some of the largest gemmae measure  $24 \times 12 \mu$ . These slight differences, however, might well come within the range of variation to be expected. In the material from Bingham Pond, Salisbury, which is likewise gemmiparous, some of the branches with gemmae proliferate and revert to an ordinary vegetative condition. When this takes place the gemmiparous leaves and underleaves become scattered along the elongated axis and show striking irregularities in shape, some of them being deeply divided into hair-like divisions. Here again the largest gemmae are about  $24 \times 12 \mu$ , although many of them are of course considerably smaller. Both here and in the original Bavarian specimens the gemmae have slightly thickened walls and are occasionally vaguely angled.

5. CEPHALOZIELLA SPINICAULIS Douin, Rev. Bryol. 40:81. 1913. On rocks. Mt. Carmel, Hamden, Connecticut (*A. W. E.*, April, 1908). Cathedral Rock, West Hartford, Connecticut (*Miss Lorenz*, March, 1914). No other localities can be cited at the present time. According to the very brief description of Douin this species differs from all other members of the genus in having the stems covered with numerous projecting cells forming blunt teeth. Nothing more is told about the plant except that it is known in sterile condition only and that the material upon which it was based was collected by the present writer. In looking through the specimens of *Cephaloziella* which were submitted to Douin for determination it was found that the material from Mt. Carmel, cited above, was named *C. Hampeana* (Nees) Schiffn., a part being referred to the forma *typica* and a part to the new variety *spinicaulis* Douin. The latter plant, therefore, which fully agrees with Douin's description, probably represents the type of *C. spinicaulis*.

The projecting cells, which Douin emphasizes so strongly, are very striking. In extreme cases numerous cells of a superficial row project and form a narrow ridge, from the margin of which rounded or bluntly conical crenulations or denticulations arise, each consisting of one or two cells. All gradations occur between this extreme condition and that in which the projecting cells are isolated and irregularly scattered. No case has been observed, however, in which a stem was smooth for any considerable distance. It may be added that the walls of the cells are thin throughout. Both leaves and underleaves are well developed. The leaves, which are transversely attached or nearly so, spread at an angle of sixty degrees or less and are more or less concave. They are bifid nearly or quite to the middle with acute lobes and sinus. Their cells average about  $10 \times 8 \mu$  and are thin-walled throughout. The margins of the leaves are sparingly crenulate or denticulate from projecting cells and the outer surface is roughened in much the same way as the stem; in other words it shows projecting cells, which are sometimes numerous, forming short and irregular ridges, and sometimes few and scattered. The underleaves are ovate and either pointed or shortly bifid at the apex. The margin and outer surface are much as in the leaves, although they tend to show fewer projecting cells.

Aside from its rough stems *C. spinicaulis* is much like *C. papillosa* Douin, a species recently reported by the writer<sup>1</sup> from Massachusetts and Connecticut. Although Douin implies that *C. spinicaulis* is the only species of the genus in which the stems are characterized by projecting cells, Howe,<sup>2</sup> in the description of his *Cephalozia divaricata scabra*, which is now considered a synonym of *C. papillosa*, states that the stems exhibit "rarely here and there minute paraphyllia-like appendages usually composed of two or three cells in a lineal series." If such structures were at all abundant they might throw doubt on the importance of the projecting cells in *C. spinicaulis* as a specific character. They must, however, be exceedingly rare because the writer has found no traces of them in most of the specimens of *C. papillosa* which he has examined. Under the circumstances, therefore, it seems justifiable to follow Douin in emphasizing the projecting cells and in considering *C. spinicaulis* a valid species. Unfortunately both the specimens studied are destitute of antheridia, archegonia, and gemmae.

<sup>1</sup> RHODORA 14 : 222. 1912.

<sup>2</sup> Mem. Torrey Club 7 : 129. 1899.

6. CALYPOGEIA PALUDOSA Warnst. Kryptogamenflora der Mark Brandenburg 2 : 1117. 1906. *C. Trichomanis*, var. *tenuis* Aust. Hep. Bor.-Amer. 74. 1873. *Kantia Trichomanis*, var. *tenuis* Underw.; A. Gray, Manual, Ed. 6, 713. 1890. *Calypogeia tenuis* Evans, RHODORA 9 : 69. 1907. According to the Vienna Rules the present species should bear the name *C. paludosa*, although Austin recognized the plant much earlier than Warnstorf and gave it the varietal name *tenuis*. When the writer raised Austin's variety to specific rank he was unaware of Warnstorf's *C. paludosa*, published the preceding year in the supplement to his Kryptogamenflora. K. Müller considers *C. paludosa* a simple synonym of *C. sphagnicola* (Arn. & Perss.) Warnst. & Loeske, but Schiffner<sup>1</sup> has recently shown that this view cannot be maintained and that *C. paludosa* is more closely allied to *C. Trichomanis* (L.) Corda than to *C. sphagnicola*. In separating it from the latter species he finds differences in both gametophyte and sporophyte. In the gametophyte he emphasizes the fact that the leaf-cells of *C. paludosa* are thin-walled throughout while those of *C. sphagnicola* are thicker and show distinct trigones. He adds that the plants in *C. paludosa* are larger than in *C. sphagnicola*, that the leaves and leaf-cells are larger, and that the underleaves are less deeply bifid and have broader lobes.

In the sporophyte he brings out the following differences: in *C. paludosa* the cells of the outer layer of the capsule wall are in eight longitudinal rows on each valve and show no traces of local thickenings in their walls, the cells of the inner layer are in sixteen longitudinal rows and show annular bands of thickening, while the spores measure 12–14  $\mu$  in diameter; in *C. sphagnicola* the cells of the outer layer are in fourteen to sixteen longitudinal rows and usually show rod-like or band-like thickenings of the radial walls (some of which extend over a portion of the outer tangential wall), the cells of the inner layer are in twenty-four longitudinal rows and show annular thickenings (much as in *C. paludosa*), while the spores measure only 9–10  $\mu$  in diameter. In Schiffner's opinion it is the structure of the capsule which shows most clearly the close relationship of *C. paludosa* to *C. Trichomanis*, although he admits that the gametophytes of the two species sometimes resemble each other very closely. He reserves the name *C. Trichomanis* for plants with a paroicous inflorescence, *C. paludosa*

<sup>1</sup> Krit. Bemerk. über europ. Leberm. 13 : 8, 9. 1914.

being characterized by an autoicous inflorescence. In one specimen of *C. paludosa*, which he distinguishes as forma *subaquatica* (Hep. eur. exsic. 621b) he found a single inflorescence with both antheridia and archegonia. This shows that *C. paludosa* is at least sometimes paroicous, but Schiffner still maintains it as a species because he has never found purely antheridial spikes in *C. Trichomanis*. His observations show that the claims of *C. paludosa* for recognition as a species rest on a rather insecure basis. It exhibits characters, however, which are usually easily recognized and there is little danger of confusing it with *C. Trichomanis* under ordinary circumstances. The plant is now definitely known from all six of the New England States.

The additions to local state floras, not already mentioned on the preceding pages, are as follows:—

For New Hampshire. *Pallavicinia Flotowiana*, Waterville (Miss Lorenz). *Lophozia Hatcheri*; Mt. Washington (Miss Lorenz).

For Vermont. *Chiloscyphus pallescens*; West Haven and Willoughby (Miss Lorenz). *Diplophyllum apiculatum*; Guilford (Miss Lorenz).

For Massachusetts. *Riccia arvensis*; New Marlboro (Miss Lorenz). *Ricciella crystallina*; Cheshire (Miss Lorenz). *Cephalozia fluitans* and *Mylia anomala*; Holden (Miss Greenwood).<sup>1</sup> *Anthoceros crispulus*; New Marlboro (Miss Lorenz).

For Connecticut. *Lophozia longidens*; foot of Pistapaug Mountain, Durham (Miss Lorenz).

The census of New England Hepaticae now stands as follows: Total number of species recorded, 184; number recorded from Maine, 128; from New Hampshire, 135; from Vermont, 119; from Massachusetts, 103; from Rhode Island, 78; from Connecticut, 140; common to all six states, 57.

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<sup>1</sup> Miss Greenwood has already reported these two species from Massachusetts. See *Bryologist* 18 : 8. 1915.